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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS AND INTERFERENCES**

In re Application of

STIESDAL et al.

Serial No.: 09/991,781

Art Unit: 3745

Filed: November 26, 2001

Examiner: C. Verdier

For: METHOD FOR IMPROVEMENT OF THE EFFICIENCY OF A WIND TURBINE
ROTOR

APPEAL BRIEF

RECEIVED

To the Commissioner of Patents and Trademarks

APR 20 2004

Sir:

TECHNOLOGY CENTER R3700

REAL PARTY IN INTEREST

Bonus Energy A/S is the real party in interest in the above-identified case by virtue of an assignment, filed January 11, 2002, and recorded on Reel/Frame 012453/0849.

RELATED APPEALS AND INTERFERENCES

No other related appeals or interferences are pending at this time.

STATUS OF CLAIMS

Claims 1-13 were cancelled without prejudice.

Claims 14-20 were finally rejected by the Examiner over prior art.

A copy of appealed claims is appended hereto in the Appendix.

STATUS OF AMENDMENTS

Amendments, filed October 22, 2003, made after the Final Office Action, were entered by the Examiner in an Advisory Action, dated November 24, 2003.

SUMMARY OF THE INVENTION

Figure 1 shows a schematic cross section of a wind turbine blade 1 having a leading edge 2, a trailing edge 3, and a lifting surface 4 between the leading edge and the trailing edge. The lifting surface has a more convex side 5 referred to as the suction side, and a less convex side 6 referred to as the pressure side. A chord 7 is an imaginary line drawn between the leading edge 2 and the trailing edge 3. (Specification page 6, lines 2-8).

Figure 2 shows a schematic plan view of a wind turbine blade 1 having a root end 8 and a tip end 9. The length of the blade from root to tip is referred to as a span. Parts of the blade near the tip are referred to as being outboard, and parts of the blade near the root are referred to as being inboard. The outboard part of the blade has an aerodynamically shaped cross-section, commonly with a profile belonging to one of numerous "families" of aerodynamic profiles used in the aeronautic industry. At the inboard part of the blade the aerodynamically shaped cross-section is commonly changed to a cylindrical cross-section at the root end. The transition from a profiled section to a circular section typically stretches from the radius of largest chord 10 to a point, normally referred to as the shoulder of the blade, to a point between the shoulder and the root. (Specification page 6, lines 9-22).

Figure 3 shows a schematic, cross-sectional view of a wind turbine blade 1 fitted with lift modifying devices commonly used on wind turbines. These devices comprise a stall strip 11, a vortex generator 12, and a Gurney flap 13. In most cases all of these types of lift modifying

devices are not used simultaneously on any given section of the blade, but may be used on different sections. (Specification page 6, line 23 to page 3, line 4).

Figures 4A and 4B are schematic, plan views of a typical a wind turbine blade fitted with lift modifying devices commonly used on wind turbines. Typical spanwise locations of stall strips 11, vortex generators 12 and Gurney flaps 13 are shown. (Specification page 7, lines 5-8).

Figures 5A and 5B are schematic, plan views of a wind turbine blade fitted with serrated trailing edge as known applied for noise reduction purposes. The serrations 14 are triangular in shape, of hexagonal cross-section and having a fairly sharp vertex angle, typically less than 30 degrees. The serrated part of the trailing edge is limited to the outboard part of the blade near the tip, having a length of typically 10-20 percent of the span. (Specification page 7, lines 9-15).

Figure 6 is a schematic, plan view of a wind turbine blade fitted with serrated trailing edge for efficiency improvement purposes in accordance with the present invention. The serrations 15 are here shown triangular in shape, of flat, rectangular or rounded cross-section and having a more blunt vertex angle than the serrations 14 for noise reduction, typically on the order of 60 degrees. The serrations may have other shapes, e.g. with rounded sides or other vertex angles than 60 degrees. The serrated part of the trailing edge is not limited to the outboard part of the blade near the tip, but has a length of typically 40-80 percent of the span. (Specification page 7, lines 16-26).

Figures 7A, 7B and 7C show a serration panel with some preferred dimensions of the serrations suitable for use on wind turbine blades of 20-50 m length. The serration panel 16 can be manufactured from a 1000 x 110 mm polycarbonate sheet. A serration tooth 17 can be an equilateral triangle with a height of 50 mm. The cross-section can be rectangular, with a

thickness of 2 mm, and the panel can be bent along the long axis, the bend 18 having an angle of 15 degrees. (Specification page 8, lines 1-8).

Figures 8A, 8B and 8C are schematic, cross-sectional views of the mounting of various preferred embodiments of the serrated panel on a wind turbine blade. A linear version of the panel 19 may be mounted on the pressure side 6 of the blade, projecting behind the trailing edge 3. A bent version of the panel 20 may also be mounted on the pressure side 6 of the blade, projecting behind the trailing edge 3, or a version 21 may be mounted on the suction side 5. The panel is manufactured in a material and thickness sufficient to ensure that the angle of the serrated part is generally unchanged irrespective of the speed and angle of the air flow at the trailing edge of the blade. (Specification page 8, lines 9-19).

Figures 9A and 9B are schematic, cross-sectional views of the mounting of another preferred embodiment of the serrated panel on a wind turbine blade. The panel 22 is mounted on the pressure side 6 of the blade and is bent along its axis. The panel is manufactured in a material and thickness sufficient to ensure that the angle of the serrated part changes in response to the speed and angle of the air flow at the trailing edge of the blade. At a fairly low ambient wind speed giving a resulting wind speed vector 23 with a shallow angle to the chord 7 the shape of the panel is close to the shape when unloaded. At a higher ambient wind speed the resulting wind speed vector 24 has a larger angle to the chord 7, and the panel flexes to a new position 25 or to any other position within a range defined by the combination of the stiffness characteristics of the serrated panel and the range of aerodynamic forces in the operating wind speed range of the wind turbine. This means that by proper tuning of the stiffness characteristics of the serrated panel the aerodynamic properties of the serrated trailing edge may be automatically and instantaneously adjusted to the actual wind conditions in a manner that is particularly beneficial

to the improvement of the efficiency of the wind turbine rotor. (Specification page 8, line 20 to page 9, line 14).

Figure 10 is a plot of the measurement of the power performance of a 1.3 MW wind turbine with 62 m rotor diameter, fitted with standard lift modifying devices commonly used on wind turbines. (Specification page 9, lines 15-18).

Figure 11 is a plot of the measurement of the power performance of the same wind turbine as shown in figure 10 but fitted with serrated trailing edges in addition to the standard lift modifying devices. The serrated edges were furnished as a retrofit with serrated panels, each panel being manufactured from 2 mm polycarbonate, having a length of 1000 mm and a width of 107 mm, and having serrations in the form of saw teeth having a height of 50 mm and 60 degrees included angles between adjacent vertices. The panels were mounted with double-adhesive tapes on the pressure side of the blade with 75 mm of the panel width (of which 50 mm were serrations) extending behind the trailing edge of the existing blade, over a spanwise extent from 50 percent radius to 90 percent radius. As a result the power curve has been shifted to the left at medium-high wind speeds, meaning that the annual energy output of the wind turbine has been improved. In the present example the improvement in annual energy output is about 4 percent. This improvement may lead to an increase in the annual energy production of about 150,000 kWh at a moderate wind site, corresponding to an increase in income of about \$6000. The cost of the serrated trailing edge panels needed for this improvement in wind turbine efficiency is less than \$100. (Specification page 9, line 19 to page 10, line 13).

In any of the embodiments described above the size, shape and flexibility of the serrations may be varied along the wingspan, and large or small portions of the wingspan may be

left without serrations, all in order to maximize the improvement in the efficiency of the wind turbine rotor. (Specification page 10, lines 14-18).

ISSUES

1. Whether claims 14-15 and 17-18 are patentable under 35 U.S.C. 103(a) over Dassen et al. (US 5,533,865) in view of Crook (US 1,724,456)?
2. Whether claims 16 and 19-20 are patentable under 35 U.S.C. 103(a) over Dassen et al. (US 5,533,865) in view of Crook (US 1,724,456) and further in view of Vijgen et al. (US 5,088,665)?
3. Whether claims 14-15 and 17-18 are patentable under 35 U.S.C. 103(a) over German Patent 311,416 in view of Dassen et al. (US 5,533,865)?
4. Whether claims 16 and 19-20 are patentable under 35 U.S.C. 103(a) over German Patent 311,416 in view of Dassen et al. (US 5,533,865) and further in view of Vijgen et al. (US 5,088,665)?

GROUPING OF CLAIMS

The claims do not stand or fall together.

ARGUMENTS

The present claims are patentable under 35 U.S.C. 103.

In considering the patentability of the present invention, it is requested that the Board consider the invention as a whole, consider the scope and content of the prior art as a whole, consider the differences between the claims at issue and the prior art, and consider the level of ordinary skill in the art to which the invention pertains at the time the invention was made.

Graham v. John Deere Co., 148 USPQ 459, 467 (1966).

THE INVENTION AS A WHOLE

The invention, considered as a whole, is best described by the appended claims.

PRIOR ART AS A WHOLE

The prior art to which the invention pertains is typified by the references of record.

DIFFERENCES BETWEEN THE INVENTION AND THE PRIOR ART

Each of the present claims defines unique features and each is individually patentable over the prior art.

The test in reviewing rejections under 35 U.S.C. 103 in which the examiner has relied on teachings of several references, is whether references, viewed individually and collectively, would have suggested claimed invention to a person possessing ordinary skill in the art, and citing references which merely indicate that isolated elements and/or features recited in the claims are known is not a sufficient basis for concluding that combination of the claimed

elements would have been obvious. Ex parte Hiyamizu, 10 USPQ2d 1393-1395 (Board of Patent Appeals and Inter., 1988); In re Kaslow, 217 USPQ 1089 (Fed. Cir. 1983); In re Deminski, 230 USPQ 313 (Fed. Cir. 1986).

Claims 14-15 and 17-18 are patentable under 35 U.S.C. 103(a) over Dassen et al. (US 5,533,865) in view of Crook (US 1,724,456).

The present claims particularly point out new and unobvious features of the invention which are not found in any reference and which would not have been obvious from the references.

Nothing in each of the references teaches or suggests the claimed features. Therefore, the references cannot anticipate nor render obvious the present invention as claimed.

Claim 14 is patentable over Dassen in view of Crook.

Claim 14 defines a method for improving efficiency of a wind turbine rotor having wind turbine rotor blades comprising, providing wind turbine rotor blades with serrated trailing edges having a plurality of spanwise, periodic indentations, extending the serrations from the trailing edges into airflow behind the trailing edges on each of the wind turbine rotor blades of the wind turbine rotor, by attaching a serrated panel to a surface of each wind turbine rotor blade near an existing trailing edge and providing the serrations in the serrated panel as a retrofit on existing wind turbine rotor blades, extending the serrations on each wind turbine rotor blade from the existing trailing edge of the wind turbine rotor blade into the airflow behind the existing trailing edge, providing the serrations on each of the wind turbine rotor blades at an angle different from 0 degrees relative to a blade chord, changing the angle of the serrated panel passively in response to speed and angle of the airflow at the trailing edges of the wind turbine rotor blades and flexing

the serrations and the serrated panel attached to the surface of each of the wind turbine rotor blades near the existing trailing edge.

Nothing in Dassen or Cook describes, teaches or suggests, all the elements of the present claims defined above.

The Examiner states that Dassen teaches improving the efficiency of a wind turbine. That is an incorrect reading of Dassen. Dassen states, in column 1, lines 16-17, lines 23-25 and lines 61-64, that the wind turbine is intended to reduce noise. Contrary to that, the present invention provides a device that has optimal performance efficiency. The results of the present invention are displayed in the so-called power curve of the wind turbine, i.e. the electrical power output from the wind turbine as a function of the wind speed. Dassen does not disclose any means for improving this parameter.

The Examiner claims that the improvement of efficiency is an inherent characteristic of noise reduction. However, nothing in the reference provides a basis for that assumption. Dassen relates to a different device and different fixing of the serrations. Dassen does not teach nor inherently provide for serrations for improving the efficiency of the wind turbine.

"The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification". In re Fritch, 23 USPQ2d 1783, 1784 (CAFC, August 1992) citing In re Gordon, 221 USPQ, 1127. In In re Gordon, the court found a proposed modification inappropriate for an obviousness inquiry when the modification rendered the prior art reference inoperable for its intended purpose.

To be anticipating, a prior art reference must disclose "each and every limitation of the claimed invention[,],... must be enabling[,], and must describe...[the] claimed invention

sufficiently to have placed it in possession of a person of ordinary skill in the field of the invention." In re Paulsen, 31 USPQ2d 1671, 1673 (Fed. Cir. 1994).

"That [the prior art] might incorporate elements which could be used in appellants' system does not render appellants' claims obvious when there is no suggestion of using these elements in substantially the same manner as appellants use them." In re Donovan, 184 USPQ 414, 421 (CCPA, 1975).

The Examiner has stated that a person of ordinary skill would readily recognize that the serrated trailing edges improve lift and drag. However, the Examiner has not supported the arguments with outside evidence or pointed to any explanation given in the Dassen reference. In the Dassen reference there is no hint or any direction to literature that supports that the skilled person should realize that a trailing edge improves lift and drag.

On the contrary, it should be noted that Dassen has disclosed serrated edges only with the purpose of reducing noise, and there is no indication that other parameters for the windmill should be effected. Accordingly, Dassen does not describe, teach or suggest the claimed invention.

With respect to Crook, Crook's "... device consists of freely moving vanes on the main wing of an aircraft ..." (column 1, lines 6, 7) and "... in a sudden 'stall' they [the vanes] become unstable and will swing instantly ..." (column 1, lines 21, 22).

Crook's device is used for aircraft in a completely different field to prevent "stall". Crook is from a different art and is not from the art to which the invention pertains. Forces acting on windmill blades are different from forces acting on wings and on small control foils attached to wings. Nothing in Crook or in the references combined with Crook would have motivated the combination of the references in the manner proposed by the Examiner. The Examiner states

that windmill blades and airplane wings are analogous arts, but only general principles are shared. The overall forces and reactions of airplane wings and windmill blades are not analogous.

Crook's Figure 2 is "a vane in larger scale than the double front and rear vanes, 106 and 99, in Figure 1 (see column 1, line 70 - column 2, line 7). The smaller auxiliary vane member is shown without a number, but is similar to elements 107 and 100 on the front and rear vanes 106 and 99 in Figure 1. The long bar that passes through vane 101 in Figure 2 is the pivot 105 or spindle 98 in Figure 1.

Nothing in Crook would have motivated adding structure of the Figure 2 enlarged view of the front and rear vane to the wind turbine blade of the present Figure 6.

Nothing in Crook would have suggested combination with Dassen. The rejections based on the combination of Crook with Dassen should be withdrawn.

The courts have held, when the prior art contains apparently conflicting references, [the Board] must weigh each reference for its power to suggest solutions to an artisan of ordinary skill. In weighing the suggestive power of each reference, [the Board] must consider the degree to which one reference might discredit another. In re Young, 18 USPQ2d 1089, 1091 (CAFC, 1991).

"It is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious." In re Fritch, 23 USPQ2d 1783, 1784 (CAFC, August 1992), quoting from In re Gorman, 18 USPQ2d 1885, 1888 (Fed. Cir. 1991). "This court has previously stated that one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." Id. quoting from In re Fine, 5 USPQ2d 1600 (CAFC, 1988).

In considering the patentability of the present invention, it is requested that the Board consider the invention as a whole, consider the scope and content of the prior art as a whole, consider the differences between the claims at issue and the prior art, and consider the level of ordinary skill in the art to which the invention pertains at the time the invention was made.

Graham v. John Deere Co., 148 USPQ 459, 467 (1966).

"The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification". In re Fritch, 23 USPQ2d 1783, 1784 (CAFC, August 1992) citing In re Gordon, 221 USPQ, 1127. In In re Gordon, the court found a proposed modification inappropriate for an obviousness inquiry when the modification rendered the prior art reference inoperable for its intended purpose.

"That [the prior art] might incorporate elements which could be used in appellants' system does not render appellants' claims obvious when there is no suggestion of using these elements in substantially the same manner as appellants use them." In re Donovan, 184 USPQ 414, 421 (CCPA, 1975).

Nothing in the references, either singly or in combination, teaches or suggests the claimed features. Therefore, the references cannot anticipate nor render obvious the present invention as claimed. It would not have been obvious to combine the references, except using impermissible hindsight reconstruction.

Therefore, claim 14 is patentable over Dassen in view of Crook.

Claim 15 is patentable over Dassen in view of Crook.

Claim 15 adds to claim 14 the step of providing serrations comprises providing the serrations on each blade over a spanwise extent of the trailing edge having a length of between about 30 and 100 percent of a radius of the blade.

There would be no incentive to combine Dassen and Cook to create serrations on each blade over a spanwise extent of the trailing edge, having a length of between about 30 and 100 percent of a radius of the blade, in combination with the patentable features of serrated edges for improved power output and windmill blades.

Nothing in the references teaches, suggests or motivates one of ordinary skill in the art to combine the references in the manner proposed by the Examiner.

Claim 17 is patentable over Dassen in view of Crook.

Claim 17 defines an apparatus for improving efficiency of a wind turbine rotor having wind turbine rotor blades comprising a serrated panel connected to each wind turbine rotor blade, an upper and a lower surface on each panel, a plurality of span-wise, periodic indentions on each panel, means for connecting the serrated panel to a trailing edge on each of the wind turbine rotor blades of the wind turbine rotor such that the serrated panel extends from the trailing edge into airflow behind the trailing edge on each wind turbine rotor blade of the wind turbine rotor, the serrations on each wind turbine rotor blade having an angle different from 0 degrees relative to a mounting surface on each of the wind turbine rotor blades of the wind turbine rotor, wherein the serrations and each of the serrated panels have a given stiffness allowing for an angle of the serrations to change passively in response to speed and angle of the airflow at the trailing edge of each of the wind turbine rotor blades due to flexing of the serrations and the serrated panel.

Nothing in Dassen or Cook describes, teaches or suggests, all the elements of the present claims defined above.

The Examiner states that Dassen teaches improving the efficiency of a wind turbine. That is an incorrect reading of Dassen. Dassen states, in column 1, lines 16-17, lines 23-25 and lines 61-64, that the wind turbine is intended to reduce noise. Contrary to that, the present invention provides a device that has optimal performance efficiency. The results of the present invention are displayed in the so-called power curve of the wind turbine, i.e. the electrical power output from the wind turbine as a function of the wind speed. Dassen does not disclose any means for improving this parameter.

The Examiner claims that the improvement of efficiency is an inherent characteristic of noise reduction. However, nothing in the reference provides a basis for that assumption. Dassen relates to a different device and different fixing of the serrations. Dassen does not teach nor inherently provide for serrations for improving the efficiency of the wind turbine.

"The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification". In re Fritch, 23 USPQ2d 1783, 1784 (CAFC, August 1992) citing In re Gordon, 221 USPQ, 1127. In In re Gordon, the court found a proposed modification inappropriate for an obviousness inquiry when the modification rendered the prior art reference inoperable for its intended purpose.

To be anticipating, a prior art reference must disclose "each and every limitation of the claimed invention[,]... must be enabling[,] and must describe...[the] claimed invention sufficiently to have placed it in possession of a person of ordinary skill in the field of the invention." In re Paulsen, 31 USPQ2d 1671, 1673 (Fed. Cir. 1994).

"That [the prior art] might incorporate elements which could be used in appellants' system does not render appellants' claims obvious when there is no suggestion of using these elements in substantially the same manner as appellants use them." In re Donovan, 184 USPQ 414, 421 (CCPA, 1975).

The Examiner has stated that a person of ordinary skill would readily recognize that the serrated trailing edges improve life and drag. However, the Examiner has not supported the arguments with outside evidence or pointed to any explanation given in the Dassen reference. In the Dassen reference there is no hint or any direction to literature that supports that the skilled person should realize that a trailing edge improves lift and drag.

On the contrary, it should be noted that Dassen has disclosed serrated edges only with the purpose of reducing noise, and there is no indication that other parameters for the windmill should be effected. Accordingly, Dassen does not describe, teach or suggest the claimed invention.

With respect to Crook, Crook's "... device consists of freely moving vanes on the main wing of an aircraft ..." (column 1, lines 6, 7) and "... in a sudden 'stall' they [the vanes] become unstable and will swing instantly ..." (column 1, lines 21, 22).

Crook's device is used for aircraft in a completely different field to prevent "stall". Crook is from a different art and is not from the art to which the invention pertains. Forces acting on windmill blades are different from forces acting on wings and on small control foils attached to wings. Nothing in Crook or in the references combined with Crook would have motivated the combination of the references in the manner proposed by the Examiner. The Examiner states that windmill blades and airplane wings are analogous arts, but only general principles are

shared. The overall forces and reactions of airplane wings and windmill blades are not analogous.

Crook's Figure 2 is "a vane in larger scale than the double front and rear vanes, 106 and 99, in Figure 1 (see column 1, line 70 - column 2, line 7). The smaller auxiliary vane member is shown without a number, but is similar to elements 107 and 100 on the front and rear vanes 106 and 99 in Figure 1. The long bar that passes through vane 101 in Figure 2 is the pivot 105 or spindle 98 in Figure 1.

Nothing in Crook would have motivated adding structure of the Figure 2 enlarged view of the front and rear vane to the wind turbine blade of the present Figure 6.

Nothing in Crook would have suggested combination with Dassen. The rejections based on the combination of Crook with Dassen should be withdrawn.

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"It is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious." In re Fritch, 23 USPQ2d 1783, 1784 (CAFC, August 1992), quoting from In re Gorman, 18 USPQ2d 1885, 1888 (Fed. Cir. 1991). "This court has previously stated that one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." Id. quoting from In re Fine, 5 USPQ2d 1600 (CAFC, 1988).

In considering the patentability of the present invention, it is requested that the Board consider the invention as a whole, consider the scope and content of the prior art as a whole, consider the differences between the claims at issue and the prior art, and consider the level of ordinary skill in the art to which the invention pertains at the time the invention was made.

Graham v. John Deere Co., 148 USPQ 459, 467 (1966).

"The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification". In re Fritch, 23 USPQ2d 1783, 1784 (CAFC, August 1992) citing In re Gordon, 221 USPQ, 1127. In In re Gordon, the court found a proposed modification inappropriate for an obviousness inquiry when the modification rendered the prior art reference inoperable for its intended purpose.

"That [the prior art] might incorporate elements which could be used in appellants' system does not render appellants' claims obvious when there is no suggestion of using these elements in substantially the same manner as appellants use them." In re Donovan, 184 USPQ 414, 421 (CCPA, 1975).

Nothing in the references, either singly or in combination, teaches or suggests the claimed features. Therefore, the references cannot anticipate nor render obvious the present invention as claimed. It would not have been obvious to combine the references, except using impermissible hindsight reconstruction.

Therefore, claim 17 is patentable over Dassen in view of Crook.

Claim 18 is patentable over Dassen in view of Crook.

Claim 18 adds to claim 17 that the serrations on each of the wind turbine rotor blades extend along a spanwise extent of the trailing edge having a length of between about 30 and 100 percent of a radius of the blade.

There would be no incentive to combine Dassen and Cook to create serrations on each blade over a spanwise extent of the trailing edge, having a length of between about 30 and 100 percent of a radius of the blade, in combination with the patentable features of serrated edges for improved power output and windmill blades.

Nothing in the references teaches, suggests or motivates one of ordinary skill in the art to combine the references in the manner proposed by the Examiner.

Claims 16 and 19-20 are patentable under 35 U.S.C. 103(a) over Dassen et al. (US 5,533,865) in view of Crook (US 1,724,456) and further in view of Vijgen et al. (US 5,088,665).

The present claims particularly point out new and unobvious features of the invention which are not found in any reference and which would not have been obvious from the references.

Nothing in each of the references teaches or suggests the claimed features. Therefore, the references cannot anticipate nor render obvious the present invention as claimed.

Claim 16 is patentable over Dassen in view of Crook and further in view of Vijgen.

The patentable features of serrated edges for improved power output and windmill blades are not found in Dassen, Crook or Vijgen. A discussion of patentability of Dassen in view of Crook is found above.

Claim 16 adds to these patentable features that the step of providing serrations comprises providing the serrations on each blade as saw-toothed serrations having approximately 60 degrees included angles between adjacent vertices.

The Examiner has relied on Vijgen as teaching saw teeth with approximately 60 degree included angles between adjacent vertices.

However, Vijgen does not mention the possibility of improving efficiency in the meaning of the electrical power output from the wind mill turbine at a given wind speed.

Nothing in Dassen, Cook or Vijgen describes, teaches or suggests, all the elements of the present claims defined above. There would be no incentive to combine Dassen, Cook and Vijgen to create serrations on each blade as saw-toothed serrations having approximately 60

degrees included angles between adjacent vertices, in combination with the patentable features of serrated edges for improved power output and windmill blades.

"It is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious." In re Fritch, 23 USPQ2d 1783, 1784 (CAFC, August 1992), quoting from In re Gorman, 18 USPQ2d 1885, 1888 (Fed. Cir. 1991). "This court has previously stated that one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." Id. quoting from In re Fine, 5 USPQ2d 1600 (CAFC, 1988).

"The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification". In re Fritch, 23 USPQ2d 1783, 1784 (CAFC, August 1992) citing In re Gordon, 221 USPQ, 1127. In In re Gordon, the court found a proposed modification inappropriate for an obviousness inquiry when the modification rendered the prior art reference inoperable for its intended purpose.

"That [the prior art] might incorporate elements which could be used in appellants' system does not render appellants' claims obvious when there is no suggestion of using these elements in substantially the same manner as appellants use them." In re Donovan, 184 USPQ 414, 421 (CCPA, 1975).

Nothing in the references, either singly or in combination, teaches or suggests the claimed features. Therefore, the references cannot anticipate nor render obvious the present invention as claimed. It would not have been obvious to combine the references, except using impermissible hindsight reconstruction.

Therefore, claim 16 is patentable over Dassen in view of Crook and further in view of Vijgen.

Claim 19 is patentable over Dassen in view of Crook and further in view of Vijgen.

The patentable features of serrated edges for improved power output and windmill blades are not found in Dassen, Crook or Vijgen. A discussion of patentability of Dassen in view of Crook is found above. Claim 19 adds to claim 17 that the serrations are saw-toothed serrations having approximately 60 degrees included angles between adjacent vertices.

The Examiner has relied on Vijgen as teaching saw teeth with approximately 60 degree included angles between adjacent vertices.

However, Vijgen does not mention the possibility of improving efficiency in the meaning of the electrical power output from the wind mill turbine at a given wind speed.

Nothing in Dassen, Cook or Vijgen describes, teaches or suggests, all the elements of the present claims defined above. There would be no incentive to combine Dassen, Cook and Vijgen to create serrations on each blade as saw-toothed serrations having approximately 60 degrees included angles between adjacent vertices, in combination with the patentable features of serrated edges for improved power output and windmill blades.

Nothing in the references teaches, suggests or motivates one of ordinary skill in the art to combine the references in the manner proposed by the Examiner.

Claim 20 is patentable over Dassen in view of Crook and further in view of Vijgen.

The patentable features of serrated edges for improved power output and windmill blades are not found in Dassen, Crook or Vijgen. A discussion of patentability of Dassen in view of Crook is found above. Claim 20 adds to claim 17 that the serrated panel further comprises saw-toothed serrations having approximately 60 degrees included angles between adjacent vertices.

The Examiner has relied on Vijgen as teaching saw teeth with approximately 60 degree included angles between adjacent vertices.

However, Vijgen does not mention the possibility of improving efficiency in the meaning of the electrical power output from the wind mill turbine at a given wind speed.

Nothing in Dassen, Cook or Vijgen describes, teaches or suggests, all the elements of the present claims defined above. There would be no incentive to combine Dassen, Cook and Vijgen to create serrations on each blade as saw-toothed serrations having approximately 60 degrees included angles between adjacent vertices, in combination with the patentable features of serrated edges for improved power output and windmill blades.

Nothing in the references teaches, suggests or motivates one of ordinary skill in the art to combine the references in the manner proposed by the Examiner.

Claims 14-15 and 17-18 are patentable under 35 U.S.C. 103(a) ver German Patent 311,416 in view of Dassen et al. (US 5,533,865).

The present claims particularly point out new and unobvious features of the invention which are not found in any reference and which would not have been obvious from the references.

Nothing in each of the references teaches or suggests the claimed features. Therefore, the references cannot anticipate nor render obvious the present invention as claimed.

Claim 14 is patentable over German Patent 311,416 in view of Dassen.

Claim 14 defines a method for improving efficiency of a wind turbine rotor having wind turbine rotor blades comprising, providing wind turbine rotor blades with serrated trailing edges having a plurality of spanwise, periodic indentations, extending the serrations from the trailing edges into airflow behind the trailing edges on each of the wind turbine rotor blades of the wind turbine rotor, by attaching a serrated panel to a surface of each wind turbine rotor blade near an existing trailing edge and providing the serrations in the serrated panel as a retrofit on existing wind turbine rotor blades, extending the serrations on each wind turbine rotor blade from the existing trailing edge of the wind turbine rotor blade into the airflow behind the existing trailing edge, providing the serrations on each of the wind turbine rotor blades at an angle different from 0 degrees relative to a blade chord, changing the angle of the serrated panel passively in response to speed and angle of the airflow at the trailing edges of the wind turbine rotor blades and flexing the serrations and the serrated panel attached to the surface of each of the wind turbine rotor blades near the existing trailing edge.

Nothing in German Patent 311,416 or Dassen describes, teaches or suggests, all the elements of the present claims defined above.

The Examiner relies on German Patent 311,416 as teaching serrated trailing edges for increasing lift and drag. However, in German Patent 311,416 there is nothing related to a possible improvement of efficiency by making use of a serrated trailing edge as uniquely defined in the present application.

The German Patent 311,416 may mention that the trailing edge b may be provided with small elastic plates cf. column 2, lines 50-65. However, those plates are incorporated in order to make use of turbulent movements in the air. Those movements could be used by having elastically bendable plates (cf. column 2, line 68 - column 3, line 22). The Examiner alleges that a person of ordinary skill would recognize that the serrated trailing edges disclosed by the German patent would improve the lift and drag, even though the reference itself does not describe, teach nor suggest the claimed invention.

The Examiner alleges that there is no explicit explanation that a serrated trailing edge should improve the efficiency of the wind turbine. However, seeing that none of the documents contain any explanation relating to efficiency in the meaning of electrical power output as a function of the wind speed, it is apparent that none of the documents are relevant when evaluating the patentability of the present invention.

With respect to the German Patent 311,416 reference, it is not known what the specification states. Figure 6 looks like 15, 12 and 9 individual elements mounted on long, medium and short poles extending separately from inner medial and outer rings. Just how the 1919 German patent could be combined with any other reference, or specifically with Dassen, is not immediately discernible. There is no motivation within the teachings of the references that would have suggested their combination at the time the invention was made.

The rejections based on combinations of German Patent 311,416 with Dassen should be withdrawn.

There would have been no motivation to combine the features of German 311,416, which shows series of feather-like elements mounted on radial rods of varied lengths, with Dassen.

The Examiner relies on Dassen as teaching an improvement for efficiency of a wind turbine. That is an incorrect reading of Dassen. Dassen states, in column 1, lines 16-17, lines 23-25 and lines 61-64, that the wind turbine is intended to reduce noise. Contrary to that, the present invention provides a device that has optimal performance efficiency. It is displayed in the so-called power curve of the wind turbine, i.e. the electrical power output from the wind turbine as a function of the wind speed. Dassen does not disclose any means for improving this parameter.

The Examiner claims that the improvement of efficiency is an inherent characteristic of noise reduction. However, nothing in the reference provides a basis for that assumption. Dassen relates to a different device and different fixing of the serrations. Dassen does not teach nor inherently provide for serrations for improving the efficiency of the wind turbine.

"The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification". In re Fritch, 23 USPQ2d 1783, 1784 (CAFC, August 1992) citing In re Gordon, 221 USPQ, 1127. In In re Gordon, the court found a proposed modification inappropriate for an obviousness inquiry when the modification rendered the prior art reference inoperable for its intended purpose.

To be anticipating, a prior art reference must disclose "each and every limitation of the claimed invention[,],... must be enabling[,], and must describe...[the] claimed invention

sufficiently to have placed it in possession of a person of ordinary skill in the field of the invention." In re Paulsen, 31 USPQ2d 1671, 1673 (Fed. Cir. 1994).

"That [the prior art] might incorporate elements which could be used in appellants' system does not render appellants' claims obvious when there is no suggestion of using these elements in substantially the same manner as appellants use them." In re Donovan, 184 USPQ 414, 421 (CCPA, 1975).

The Examiner has stated that a person of ordinary skill would readily recognize that the serrated trailing edges improve that life and drag. However, the Examiner has not the arguments with outside evidence or pointed to any explanation given in the Dassen patent. In the Dassen patent there is no hint or any direction to literature that supports that the skilled man should realize that a trailing edge improves lift and drag.

On the contrary, it should be noted that Dassen has disclosed serrated edges only with the purpose of reducing noise, and there is no indication that other parameters for the windmill should be effected. Accordingly, Dassen does not describe, teach or suggest the claimed invention.

Nothing in German Patent 311,416 would have suggested combination with Dassen. The rejections based on the combination of German Patent 311,416 with Dassen should be withdrawn.

The courts have held, when the prior art contains apparently conflicting references, [the Board] must weigh each reference for its power to suggest solutions to an artisan of ordinary skill. In weighing the suggestive power of each reference, [the Board] must consider the degree to which one reference might discredit another. In re Young, 18 USPQ2d 1089, 1091 (CAFC, 1991).

"It is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious." In re Fritch, 23 USPQ2d 1783, 1784 (CAFC, August 1992), quoting from In re Gorman, 18 USPQ2d 1885, 1888 (Fed. Cir. 1991). "This court has previously stated that one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." Id. quoting from In re Fine, 5 USPQ2d 1600 (CAFC, 1988).

In considering the patentability of the present invention, it is requested that the Board consider the invention as a whole, consider the scope and content of the prior art as a whole, consider the differences between the claims at issue and the prior art, and consider the level of ordinary skill in the art to which the invention pertains at the time the invention was made. Graham v. John Deere Co., 148 USPQ 459, 467 (1966).

"The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification". In re Fritch, 23 USPQ2d 1783, 1784 (CAFC, August 1992) citing In re Gordon, 221 USPQ, 1127. In In re Gordon, the court found a proposed modification inappropriate for an obviousness inquiry when the modification rendered the prior art reference inoperable for its intended purpose.

"That [the prior art] might incorporate elements which could be used in appellants' system does not render appellants' claims obvious when there is no suggestion of using these elements in substantially the same manner as appellants use them." In re Donovan, 184 USPQ 414, 421 (CCPA, 1975).

Nothing in the references, either singly or in combination, teaches or suggests the claimed features. Therefore, the references cannot anticipate nor render obvious the present

invention as claimed. It would not have been obvious to combine the references, except using impermissible hindsight reconstruction.

Therefore, claim 14 is patentable over German Patent 311,416 in view of Dassen.

Claim 15 is patentable over German Patent 311,416 in view of Dassen.

Claim 15 adds to claim 14 the step of providing serrations comprises providing the serrations on each blade over a spanwise extent of the trailing edge having a length of between about 30 and 100 percent of a radius of the blade.

There would be no incentive to combine German Patent 311,416 and Dassen to create serrations on each blade over a spanwise extent of the trailing edge, having a length of between about 30 and 100 percent of a radius of the blade, in combination with the patentable features of serrated edges for improved power output, life, drag and efficiency as a function of wind speed and windmill blades.

Nothing in the references teaches, suggests or motivates one of ordinary skill in the art to combine the references in the manner proposed by the Examiner.

Claim 17 is patentable over German Patent 311,416 in view of Dassen.

Claim 17 defines an apparatus for improving efficiency of a wind turbine rotor having wind turbine rotor blades comprising a serrated panel connected to each wind turbine rotor blade, an upper and a lower surface on each panel, a plurality of span-wise, periodic indentions on each panel, means for connecting the serrated panel to a trailing edge on each of the wind turbine rotor blades of the wind turbine rotor such that the serrated panel extends from the trailing edge into airflow behind the trailing edge on each wind turbine rotor blade of the wind turbine rotor, the serrations on each wind turbine rotor blade having an angle different from 0 degrees relative to a mounting surface on each of the wind turbine rotor blades of the wind turbine rotor, wherein the

serrations and each of the serrated panels have a given stiffness allowing for an angle of the serrations to change passively in response to speed and angle of the airflow at the trailing edge of each of the wind turbine rotor blades due to flexing of the serrations and the serrated panel.

Nothing in German Patent 311,416 or Dassen describes, teaches or suggests, all the elements of the present claims defined above.

The Examiner relies on German Patent 311,416 as teaching serrated trailing edges for increasing lift and drag. However, in German Patent 311,416 there is nothing related to a possible improvement of efficiency by making use of a serrated trailing edge as uniquely defined in the present application.

The German patent may mention that the trailing edge b may be provided with small elastic plates cf. column 2, lines 50-65. However, those plates are incorporated in order to make use of turbulent movements in the air. Those movements could be used by having elastically bendable plates (cf. column 2, line 68 - column 3, line 22). The Examiner alleges that a person of ordinary skill would recognize that the serrated trailing edges disclosed by the German patent would improve the lift and drag, even though the reference itself does not describe, teach nor suggest the claimed invention.

The Examiner alleges that there is no explicit explanation that a serrated trailing edge should improve the efficiency of the wind turbine. However, seeing that none of the documents contain any explanation relating to efficiency in the meaning of electrical power output as a function of the wind speed, it is apparent that none of the documents are relevant when evaluating the patentability of the present invention.

With respect to the German Patent 311,416 reference, it is not known what the specification states. Figure 6 looks like 15, 12 and 9 individual elements mounted on long,

medium and short poles extending separately from inner medial and outer rings. Just how the 1919 German patent could be combined with any other reference, or specifically with Dassen, is not immediately discernible. There is no motivation within the teachings of the references that would have suggested their combination at the time the invention was made.

The rejections based on combinations of German Patent 311,416 with Dassen should be withdrawn.

There would have been no motivation to combine the features of German 311,416, which shows series of feather-like elements mounted on radial rods of varied lengths, with Dassen.

The Examiner relies on Dassen as teaching an improvement for efficiency of a wind turbine. That is an incorrect reading of Dassen. Dassen states, in column 1, lines 16-17, lines 23-25 and lines 61-64, that the wind turbine is intended to reduce noise. Contrary to that, the present invention provides a device that has optimal performance efficiency. It is displayed in the so-called power curve of the wind turbine, i.e. the electrical power output from the wind turbine as a function of the wind speed. Dassen does not disclose any means for improving this parameter.

The Examiner claims that the improvement of efficiency is an inherent characteristic of noise reduction. However, nothing in the reference provides a basis for that assumption. Dassen relates to a different device and different fixing of the serrations. Dassen does not teach nor inherently provide for serrations for improving the efficiency of the wind turbine.

"The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification". In re Fritch, 23 USPQ2d 1783, 1784 (CAFC, August 1992) citing In re Gordon, 221 USPQ, 1127. In In re Gordon, the court found a proposed modification

inappropriate for an obviousness inquiry when the modification rendered the prior art reference inoperable for its intended purpose.

To be anticipating, a prior art reference must disclose "each and every limitation of the claimed invention[,],... must be enabling[,], and must describe...[the] claimed invention sufficiently to have placed it in possession of a person of ordinary skill in the field of the invention." In re Paulsen, 31 USPQ2d 1671, 1673 (Fed. Cir. 1994).

"That [the prior art] might incorporate elements which could be used in appellants' system does not render appellants' claims obvious when there is no suggestion of using these elements in substantially the same manner as appellants use them." In re Donovan, 184 USPQ 414, 421 (CCPA, 1975).

The Examiner has stated that a person of ordinary skill would readily recognize that the serrated trailing edges improve that life and drag. However, the Examiner has not the arguments with outside evidence or pointed to any explanation given in the Dassen patent. In the Dassen patent there is no hint or any direction to literature that supports that the skilled man should realize that a trailing edge improves lift and drag.

On the contrary, it should be noted that Dassen has disclosed serrated edges only with the purpose of reducing noise, and there is no indication that other parameters for the windmill should be effected. Accordingly, Dassen does not describe, teach or suggest the claimed invention.

Nothing in German Patent 311,416 would have suggested combination with Dassen. The rejections based on the combination of German Patent 311,416 with Dassen should be withdrawn.

"It is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious." In re Fritch, 23 USPQ2d 1783, 1784 (CAFC, August 1992), quoting from In re Gorman, 18 USPQ2d 1885, 1888 (Fed. Cir. 1991). "This court has previously stated that one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." Id. quoting from In re Fine, 5 USPQ2d 1600 (CAFC, 1988).

"The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification". In re Fritch, 23 USPQ2d 1783, 1784 (CAFC, August 1992) citing In re Gordon, 221 USPQ, 1127. In In re Gordon, the court found a proposed modification inappropriate for an obviousness inquiry when the modification rendered the prior art reference inoperable for its intended purpose.

"That [the prior art] might incorporate elements which could be used in appellants' system does not render appellants' claims obvious when there is no suggestion of using these elements in substantially the same manner as appellants use them." In re Donovan, 184 USPQ 414, 421 (CCPA, 1975).

Nothing in the references, either singly or in combination, teaches or suggests the claimed features. Therefore, the references cannot anticipate nor render obvious the present invention as claimed. It would not have been obvious to combine the references, except using impermissible hindsight reconstruction.

Therefore, claim 17 is patentable over German Patent 311,416 in view of Dassen.

Claim 18 is patentable over German Patent 311,416 in view of Dassen.

Claim 18 adds to claim 17 that the serrations on each of the wind turbine rotor blades extend along a spanwise extent of the trailing edge having a length of between about 30 and 100 percent of a radius of the blade.

There would be no incentive to combine German Patent 311,416 and Dassen to create serrations on each blade over a spanwise extent of the trailing edge, having a length of between about 30 and 100 percent of a radius of the blade, in combination with the patentable features of serrated edges for improved power output, life, drag and efficiency as a function of wind speed and windmill blades.

Nothing in the references teaches, suggests or motivates one of ordinary skill in the art to combine the references in the manner proposed by the Examiner.

Claims 16 and 19-20 are patentable over German Patent 311,416 in view of Dassen et al. (US 5,533,865) and further in view of Vijgen et al. (US 5,088,665).

The present claims particularly point out new and unobvious features of the invention which are not found in any reference and which would not have been obvious from the references.

Nothing in each of the references teaches or suggests the claimed features. Therefore, the references cannot anticipate nor render obvious the present invention as claimed.

Claim 16 is patentable over German Patent 311,416 in view of Dassen and further in view of Vijgen.

The patentable features of serrated edges for improved power output, life, drag and efficiency as a function of wind speed and windmill blades are not found in German Patent 311,416, Dassen or Vijgen. A discussion of patentability of German Patent 311,416 in view of Dassen is found above.

Claim 16 adds to claim 14 that the step of providing serrations comprises providing the serrations on each blade as saw-toothed serrations having approximately 60 degrees included angles between adjacent vertices.

The Examiner has relied on Vijgen as teaching saw teeth with approximately 60 degree included angles between adjacent vertices.

However, Vijgen does not mention the possibility of improving efficiency in the meaning of the electrical power output from the wind mill turbine at a given wind speed.

Nothing in German Patent 311,416, Dassen or Vijgen describes, teaches or suggests, all the elements of the present claims defined above. There would be no incentive to combine German Patent 311,416, Dassen and Vijgen to create serrations on each blade as saw-toothed

serrations having approximately 60 degrees included angles between adjacent vertices, in combination with the patentable features of serrated edges for improved power output, life, drag and efficiency as a function of wind speed and windmill blades.

To be anticipating, a prior art reference must disclose "each and every limitation of the claimed invention[,],... must be enabling[,], and must describe...[the] claimed invention sufficiently to have placed it in possession of a person of ordinary skill in the field of the invention." In re Paulsen, 31 USPQ2d 1671, 1673 (Fed. Cir. 1994).

"That [the prior art] might incorporate elements which could be used in appellants' system does not render appellants' claims obvious when there is no suggestion of using these elements in substantially the same manner as appellants use them." In re Donovan, 184 USPQ 414, 421 (CCPA, 1975).

Nothing in German Patent 311,416 would have suggested combination with Dassen and Vijgen. The rejections based on the combination of German Patent 311,416 with Dassen and Vijgen should be withdrawn. Nothing in German Patent 311,416 or Dassen describes, teaches or suggests, all the elements of the present claims defined above.

"The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification". In re Fritch, 23 USPQ2d 1783, 1784 (CAFC, August 1992) citing In re Gordon, 221 USPQ, 1127. In In re Gordon, the court found a proposed modification inappropriate for an obviousness inquiry when the modification rendered the prior art reference inoperable for its intended purpose.

"That [the prior art] might incorporate elements which could be used in appellants' system does not render appellants' claims obvious when there is no suggestion of using these

elements in substantially the same manner as appellants use them." In re Donovan, 184 USPQ 414, 421 (CCPA, 1975).

Nothing in the references, either singly or in combination, teaches or suggests the claimed features. Therefore, the references cannot anticipate nor render obvious the present invention as claimed. It would not have been obvious to combine the references, except using impermissible hindsight reconstruction.

Therefore, claim 16 is patentable over German Patent 311,416 in view of Dassen and further in view of Vijgen.

Claim 19 is patentable over German Patent 311,416 in view of Dassen and further in view of Vijgen.

The patentable features of serrated edges for improved power output, life, drag and efficiency as a function of wind speed and windmill blades are not found in German Patent 311,416, Dassen or Vijgen. A discussion of patentability of German Patent 311,416 in view of Dassen is found above. Claim 19 adds to claim 17 that the serrations are saw-toothed serrations having approximately 60 degrees included angles between adjacent vertices.

Nothing in German Patent 311,416, Dassen or Vijgen describes, teaches or suggests, all the elements of the present claims defined above. There would be no incentive to combine German Patent 311,416, Dassen and Vijgen to create saw-toothed serrations having approximately 60 degrees included angles between adjacent vertices, in combination with the patentable features of serrated edges for improved power output, life, drag and efficiency as a function of wind speed and windmill blades.

Nothing in the references teaches, suggests or motivates one of ordinary skill in the art to combine the references in the manner proposed by the Examiner.

Claim 20 is patentable over German Patent 311,416 in view of Dassen and further in view of Vijgen.

The patentable features of serrated edges for improved power output, life, drag and efficiency as a function of wind speed and windmill blades are not found in German Patent 311,416, Dassen or Vijgen. A discussion of patentability of German Patent 311,416 in view of Dassen is found above. Claim 20 adds to claim 17 that the serrated panel further comprises saw-toothed serrations having approximately 60 degrees included angles between adjacent vertices.

Nothing in German Patent 311,416, Dassen or Vijgen describes, teaches or suggests, all the elements of the present claims defined above. There would be no incentive to combine German Patent 311,416, Dassen and Vijgen to create a serrated panel with saw-toothed serrations having approximately 60 degrees included angles between adjacent vertices, in combination with the other patentable features of serrated edges for improved power output, life, drag and efficiency as a function of wind speed and windmill blades.

Nothing in the references teaches, suggests or motivates one of ordinary skill in the art to combine the references in the manner proposed by the Examiner.

LEVEL OF ORDINARY SKILL IN THE ART

A person having ordinary skill in the art is an artisan being taught the reference teachings.

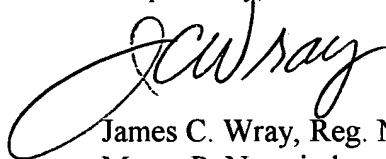
SUMMARY

When considering the present invention as a whole and the prior art to which the invention pertains as a whole, when considering the differences between the present invention and the prior art, and when considering the level of ordinary skill in the art to which the invention pertains, it is clear that the invention would not have been obvious under 35 U.S.C. 103 to a person having ordinary skill in the art at the time the invention was made.

CONCLUSION

Reversal of the Examiner and allowance of all the claims are respectfully requested.

Respectfully,

A handwritten signature in black ink, appearing to read 'J. Wray', with a large, sweeping initial 'J'.

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Date: April 16, 2004

APPENDIX

14. A method for improving efficiency of a wind turbine rotor having wind turbine rotor blades comprising, providing wind turbine rotor blades with serrated trailing edges having a plurality of spanwise, periodic indentations, extending the serrations from the trailing edges into airflow behind the trailing edges on each of the wind turbine rotor blades of the wind turbine rotor, by attaching a serrated panel to a surface of each wind turbine rotor blade near an existing trailing edge and providing the serrations in the serrated panel as a retrofit on existing wind turbine rotor blades, extending the serrations on each wind turbine rotor blade from the existing trailing edge of the wind turbine rotor blade into the airflow behind the existing trailing edge, providing the serrations on each of the wind turbine rotor blades at an angle different from 0 degrees relative to a blade chord, changing the angle of the serrated panel passively in response to speed and angle of the airflow at the trailing edges of the wind turbine rotor blades and flexing the serrations and the serrated panel attached to the surface of each of the wind turbine rotor blades near the existing trailing edge.

15. The method of claim 14, wherein the step of providing serrations comprises providing the serrations on each blade over a spanwise extent of the trailing edge having a length of between about 30 and 100 percent of a radius of the blade.

16. The method of claim 14, wherein the step of providing serrations comprises providing the serrations on each blade as saw-toothed serrations having approximately 60 degrees included angles between adjacent vertices.

17. An apparatus for improving efficiency of a wind turbine rotor having wind turbine rotor blades comprising a serrated panel connected to each wind turbine rotor blade, an upper

and a lower surface on each panel, a plurality of span-wise, periodic indentions on each panel, means for connecting the serrated panel to a trailing edge on each of the wind turbine rotor blades of the wind turbine rotor such that the serrated panel extends from the trailing edge into airflow behind the trailing edge on each wind turbine rotor blade of the wind turbine rotor, the serrations on each wind turbine rotor blade having an angle different from 0 degrees relative to a mounting surface on each of the wind turbine rotor blades of the wind turbine rotor, wherein the serrations and each of the serrated panels have a given stiffness allowing for an angle of the serrations to change passively in response to speed and angle of the airflow at the trailing edge of each of the wind turbine rotor blades due to flexing of the serrations and the serrated panel.

18. The apparatus of claim 17, wherein the serrations on each of the wind turbine rotor blades extend along a spanwise extent of the trailing edge having a length of between about 30 and 100 percent of a radius of the blade.

19. The apparatus of claim 17, wherein the serrations are saw-toothed serrations having approximately 60 degrees included angles between adjacent vertices.

20. The apparatus of claim 17, wherein the serrated panel further comprises saw-toothed serrations having approximately 60 degrees included angles between adjacent vertices.